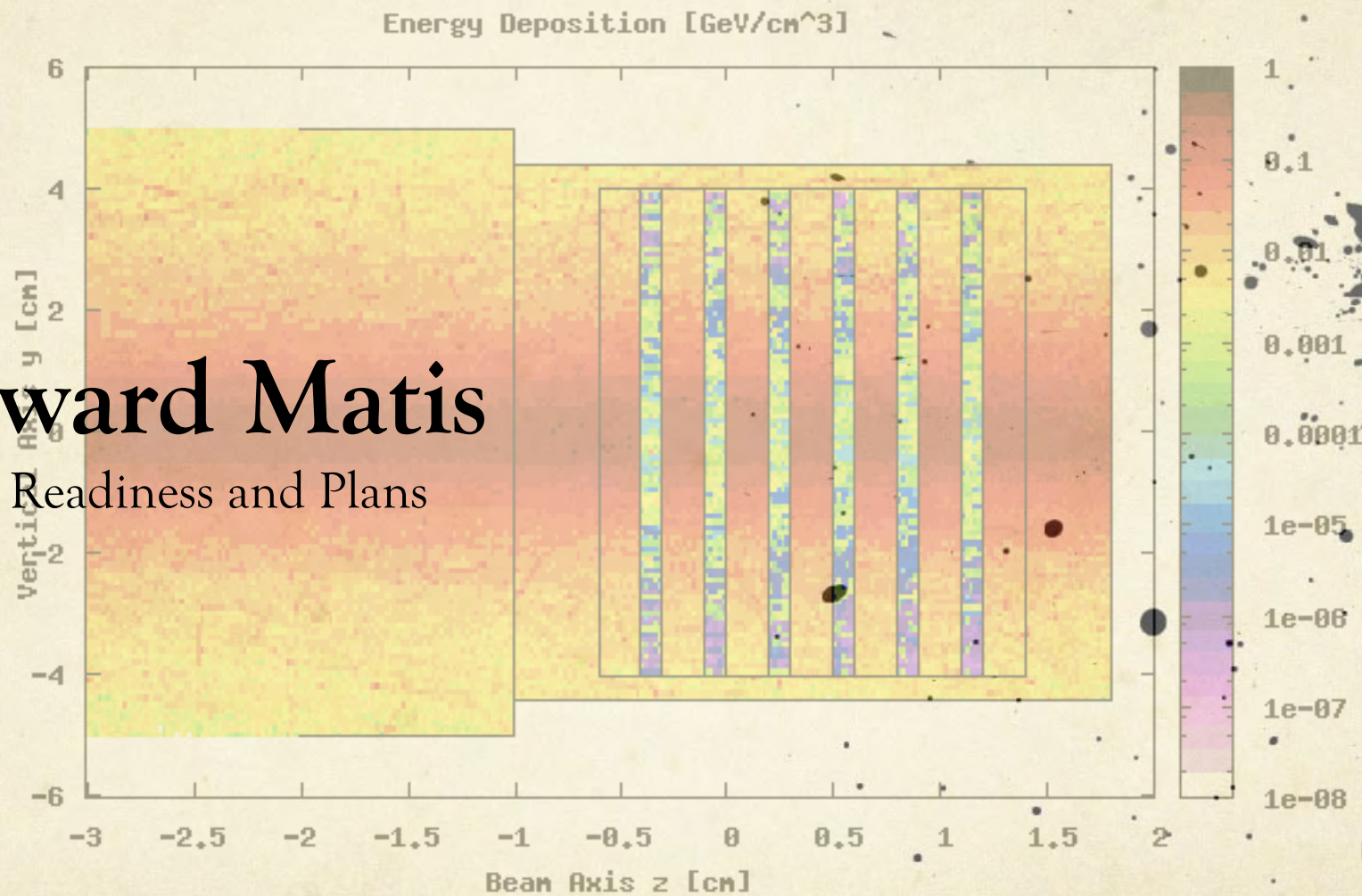


Howard Matis

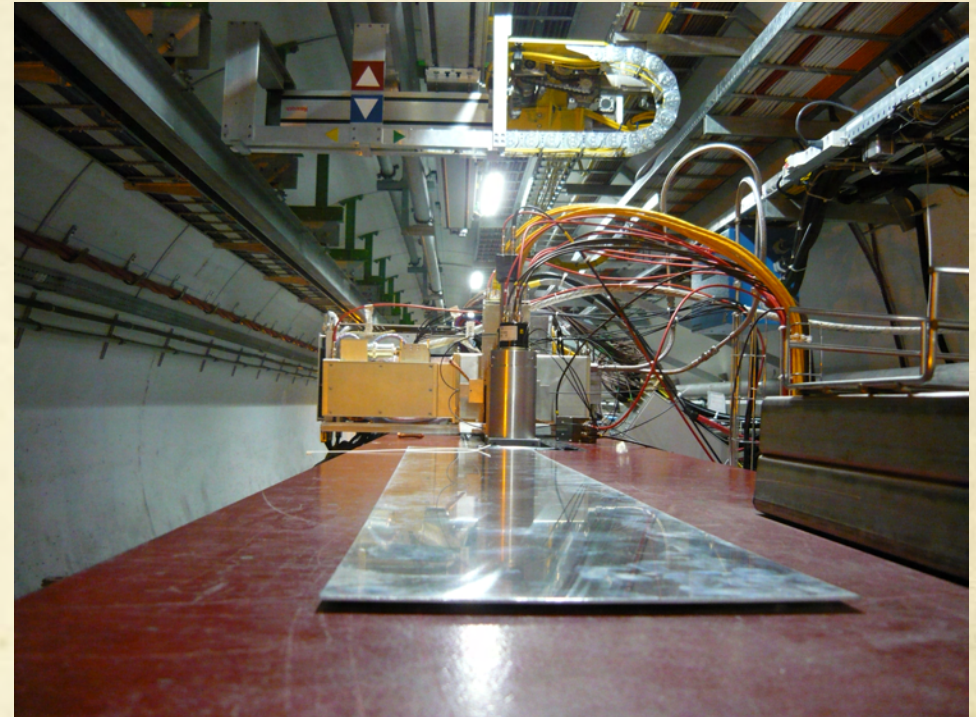
LUMI Readiness and Plans



Purpose

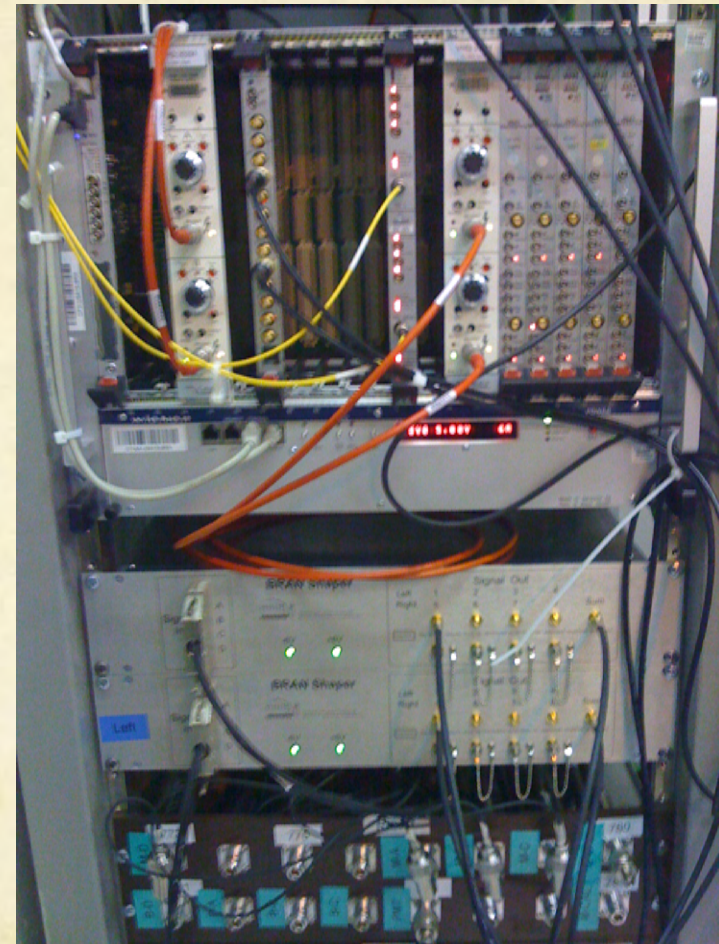
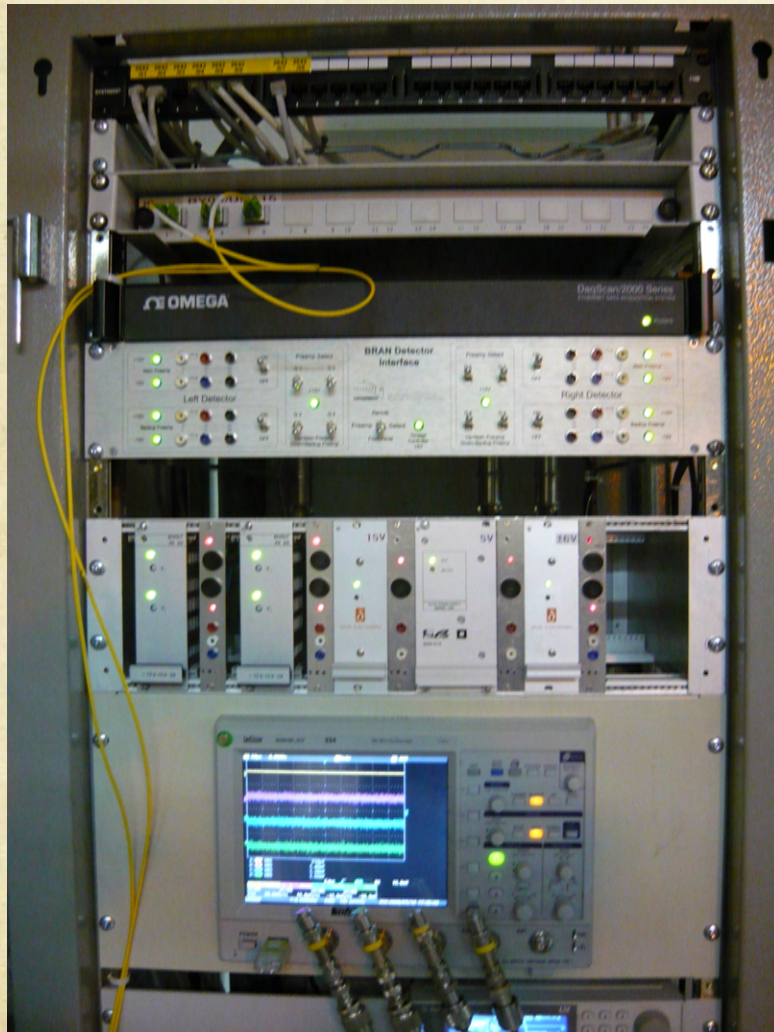
- Measure bunch by bunch relative luminosity
- 7 TeV operations
- Located at Point 1 - Atlas
- Located at Point 5 - CMS

BRAN installed @ 1R (Atlas)



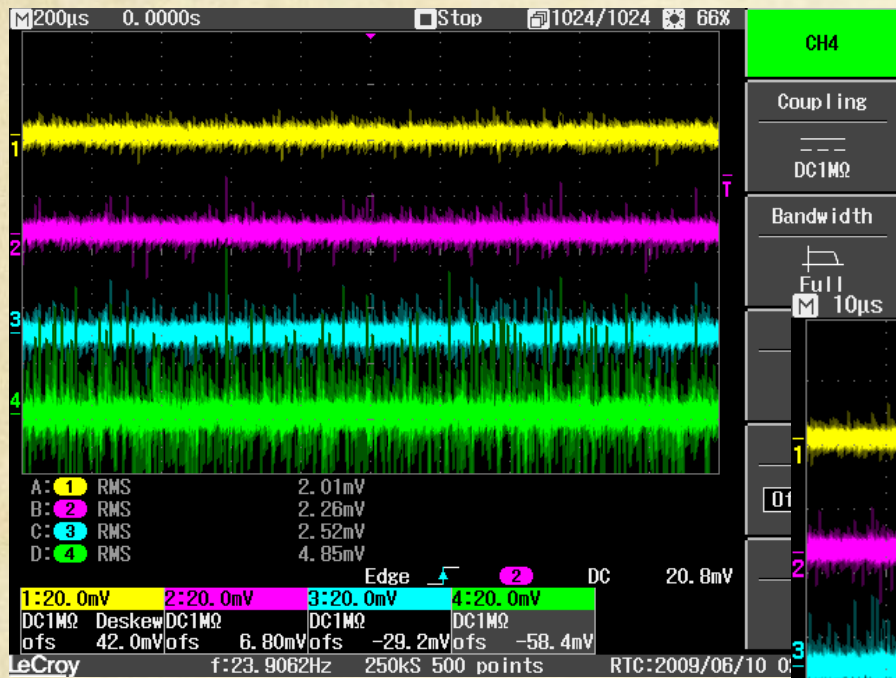
3

BRAN Rack at Point 1

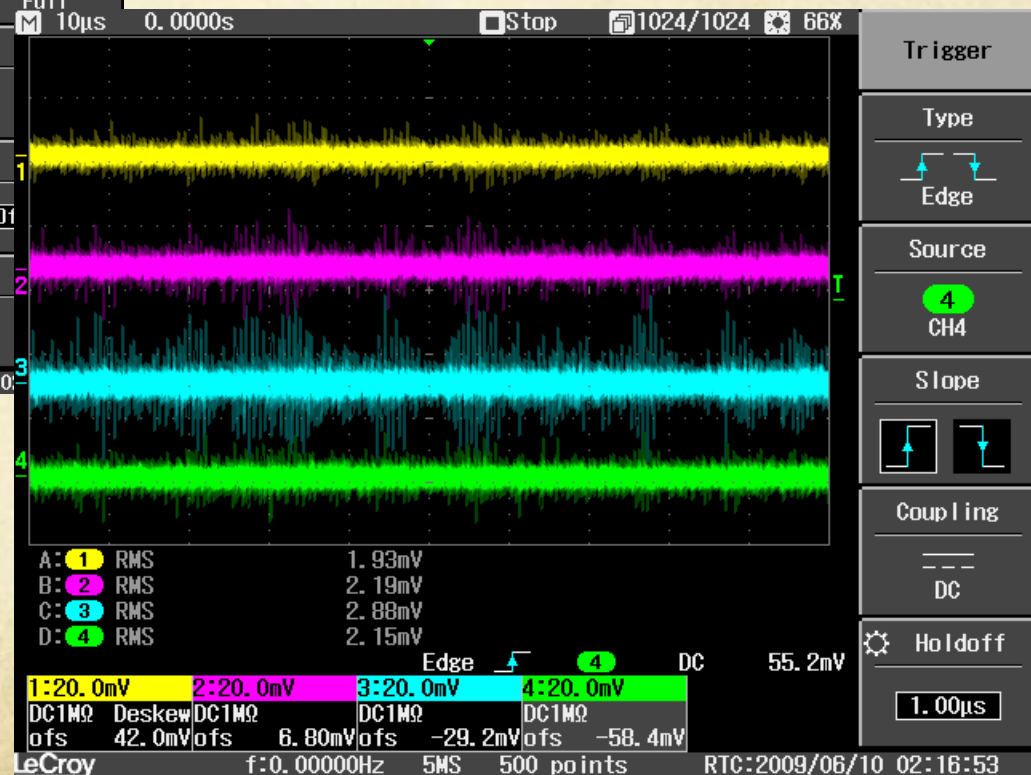


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Point 1 Noise Measurements

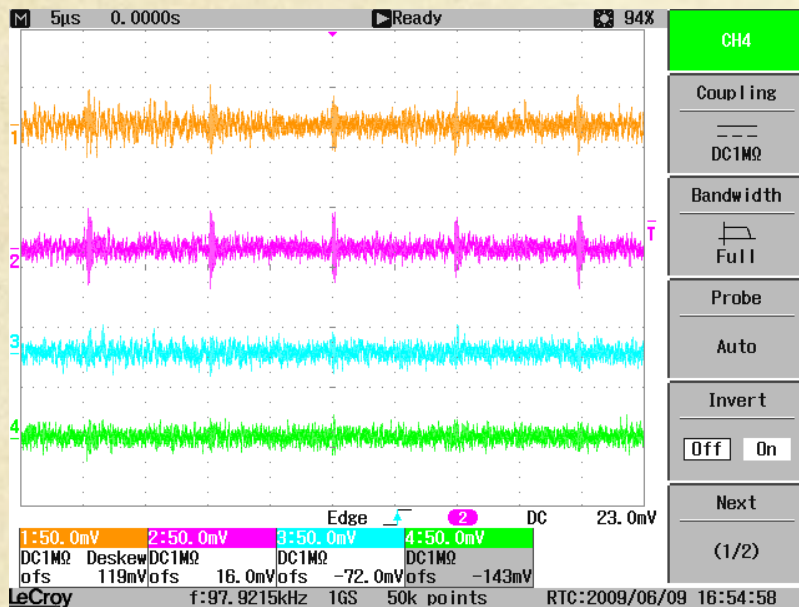


Levels very similar to Point 5
Noise levels low
No 10 µs structure

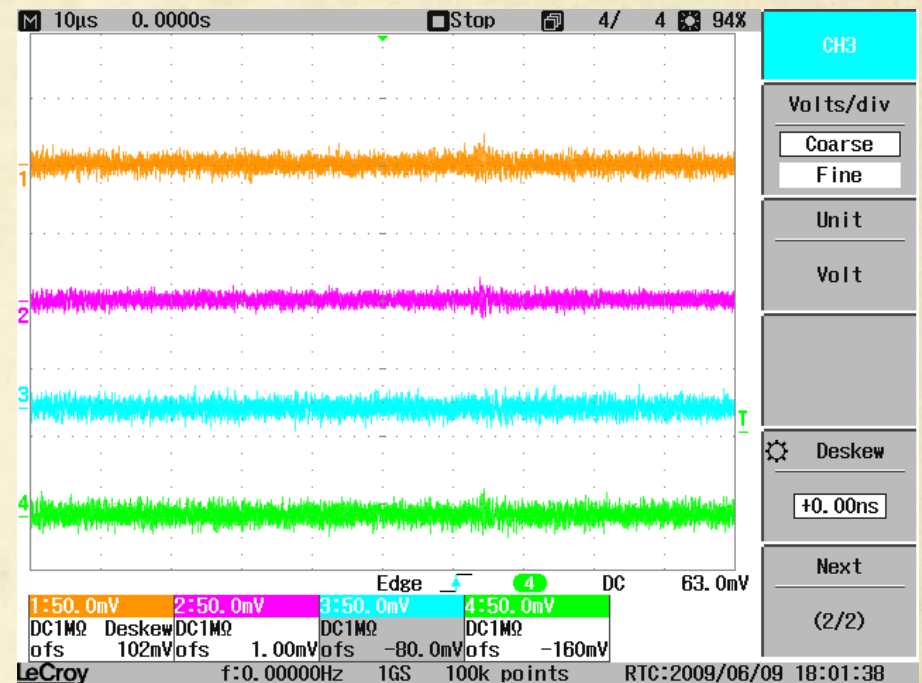


Note – Noisy channel fixed in July

Point 5 Electronics - Noise



Left side

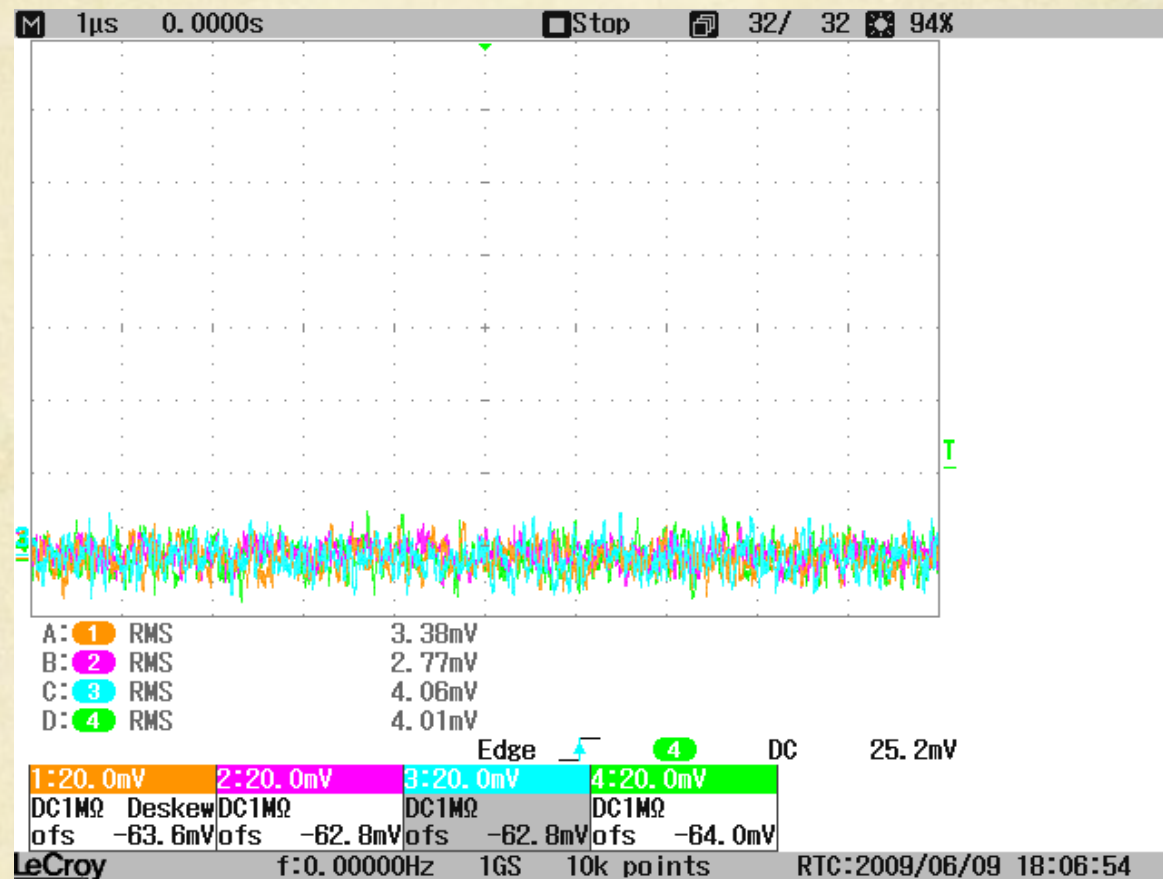


Right Side

Noise after the preamp - shaper is effective in reducing 10 us structure

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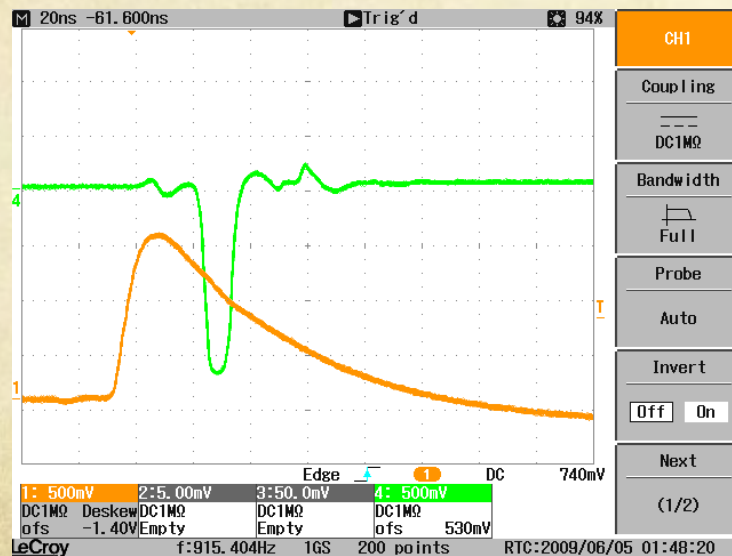
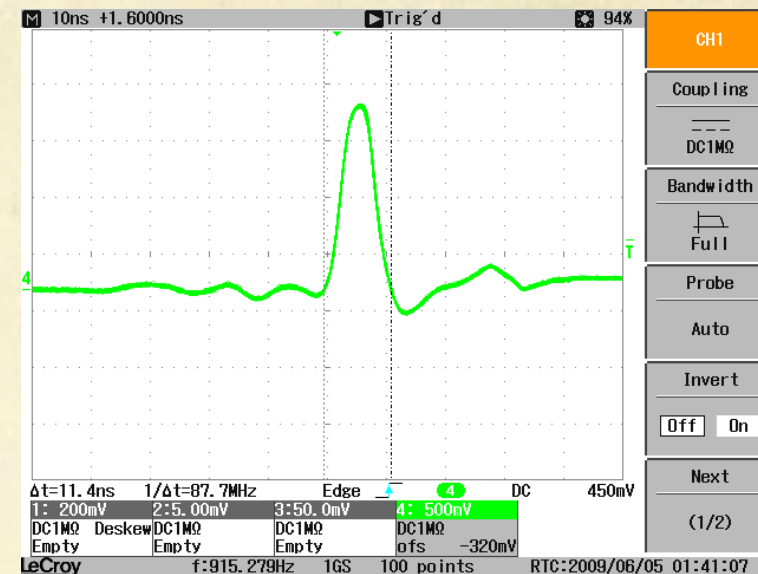
Point 5 Noise Measurement



Unterminated output of the preamp after cables @ the rack

Signal Tests at Point 5L

Inject pulse at detector
Signal at shaper output
10 ns/div

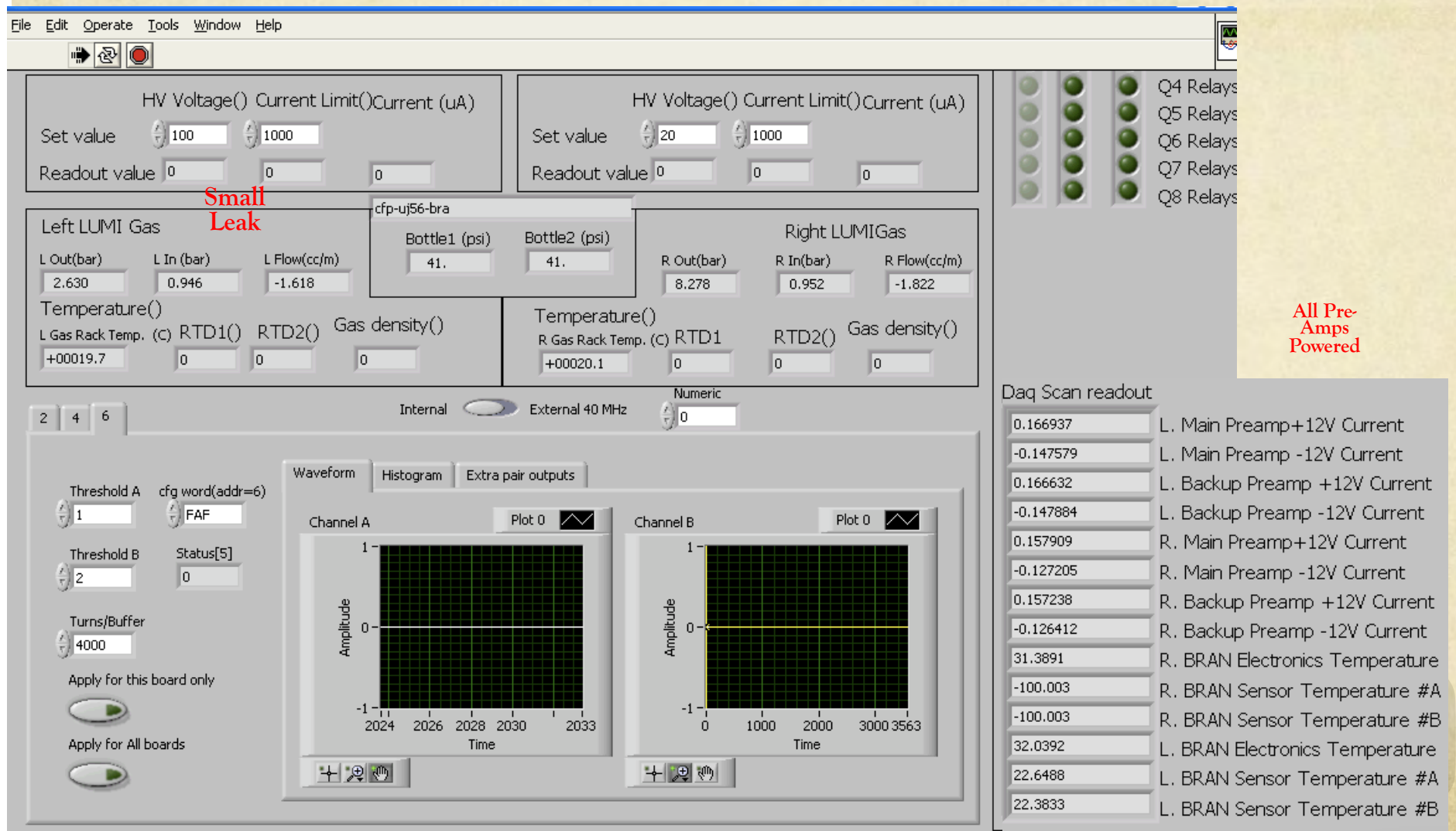


Pre-Amp and shaper
20 ns/div

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Point 5 Controller



Gas set at 10 atm on 9 June – Snapshot taken on 21 June

Lumi HW Commissioning Recap

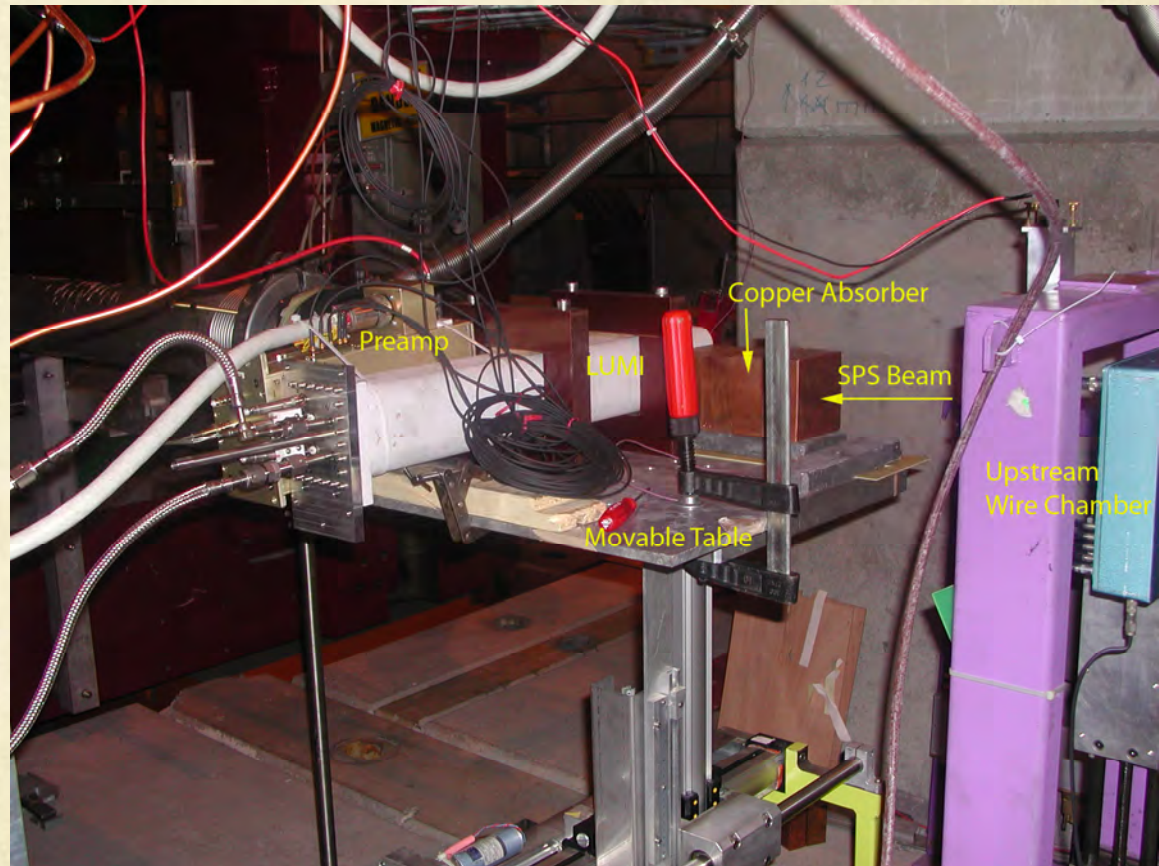
- Persistent 10 μ s noise at 5R (ch A, B)
 - Filtered by shapers
- Occasional reboot of gas controller still needed
- Need software HV Interlock of gas pressure
- CERN fixing gas leaks

Testing and Modeling

- Goals
 - Understand test of detector at SPS
 - Test our knowledge of Monte Carlo models so that we can use it as a tool
- Method
 - Use FLUKA to model detector response

SPS Test

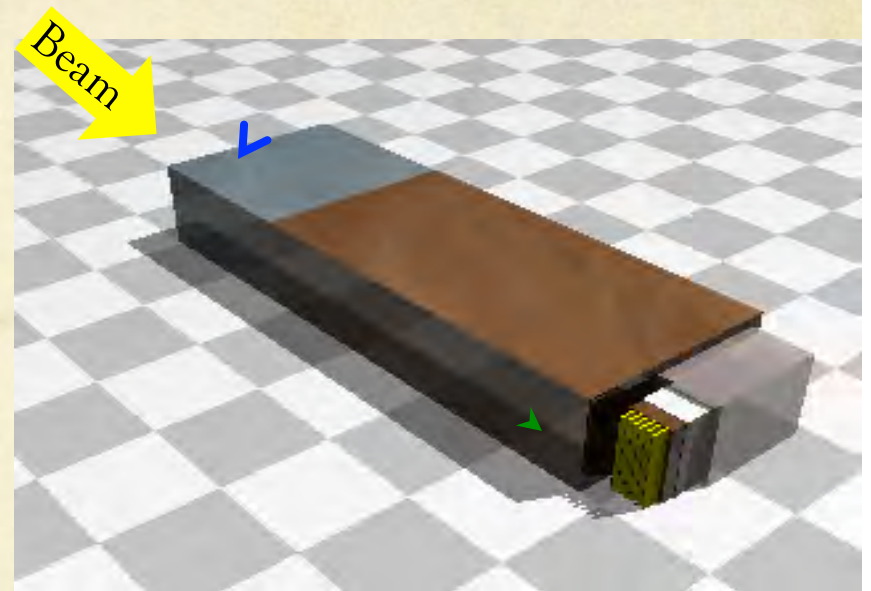
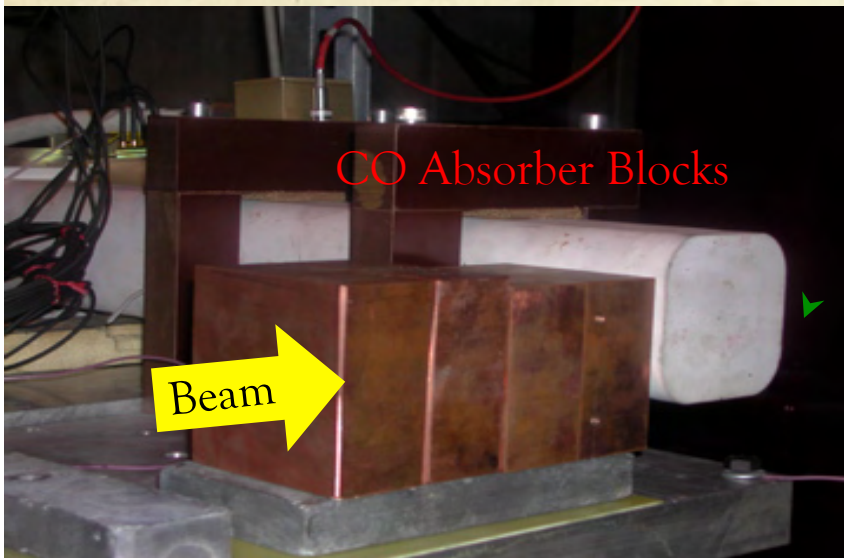
- 350 GeV p's
- Final prototype
- Analog electronics
- Trigger on scintillator
- Beam width
 - $\sigma \sim \text{mm}$



BRAN Setup SPS vs. Simulation

Ionization Chamber

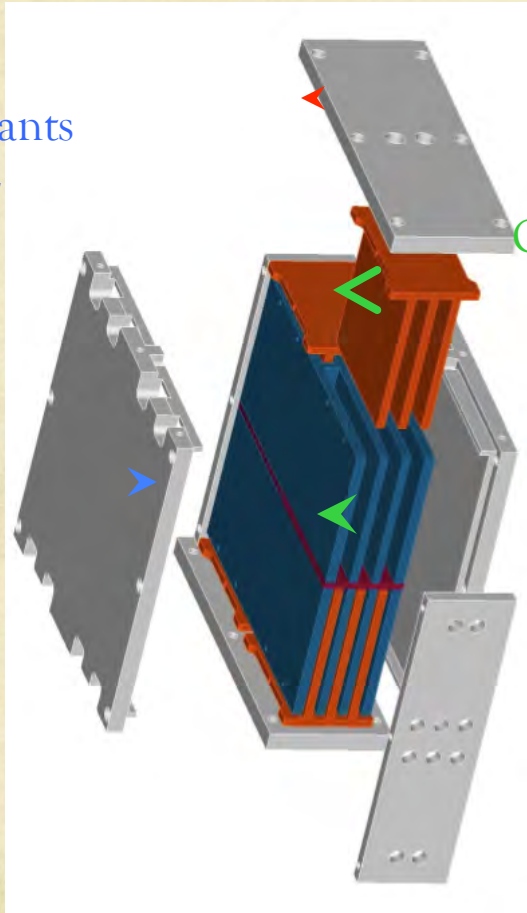
Air



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Detailed BRAN Setup

Quadrants
1-4

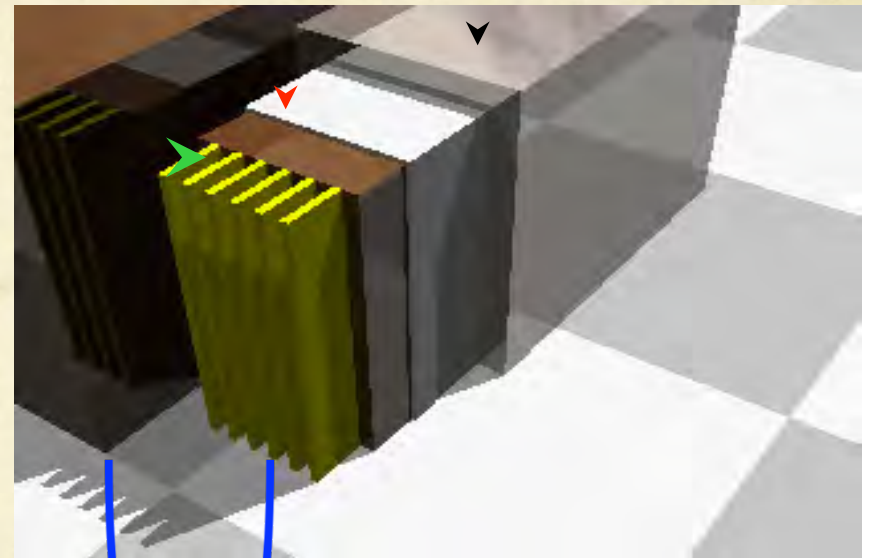


Ceramic Cover

Copper

6 Gaps of Gas

Stainless Steel Housing



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Absolute Pulse Height Calculation

Energy to produce an ion-electron pair in Ar

From Fluka

Amplifier gain

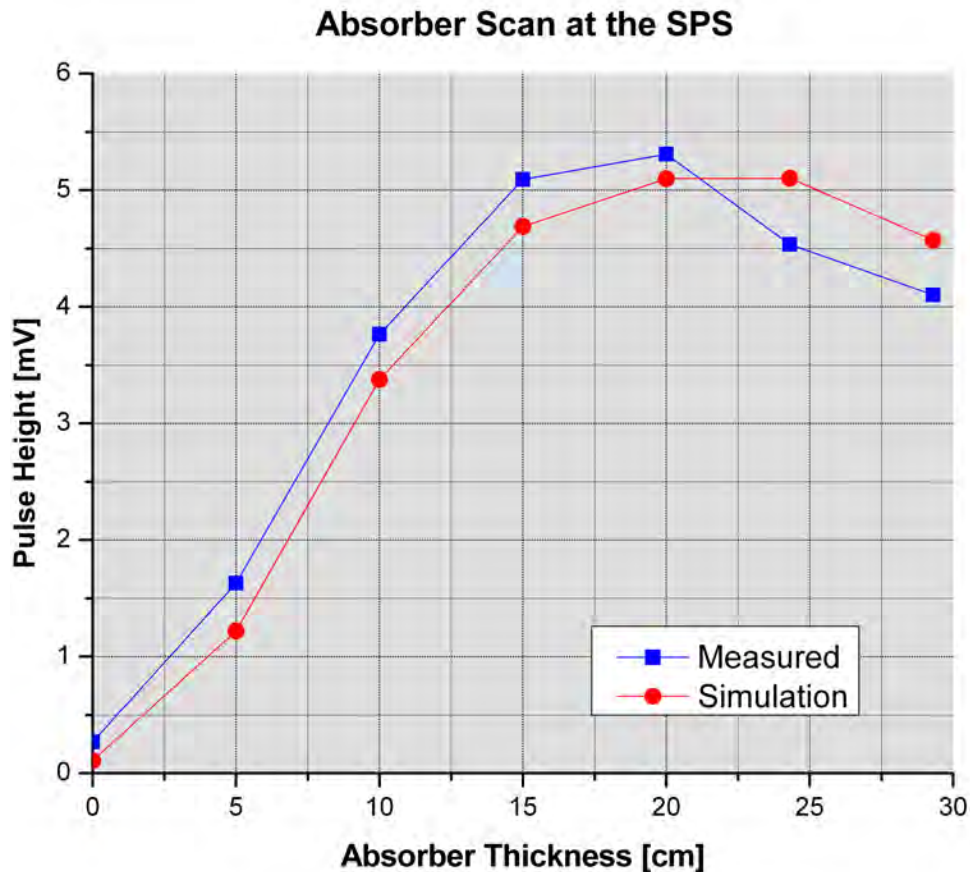
Cable
attenuation

$$U = \frac{1}{2} \frac{\overset{\vee}{E}_{Deposited}}{\overset{\vee}{W}} \frac{\overset{\vee}{g} \cdot \overset{\vee}{\lambda}}{\overset{\vee}{B}_d}$$

▼
Since collecting the image
charge

▼
From a finite integration
time of a triangular pulse
(Ballistic Deficit)

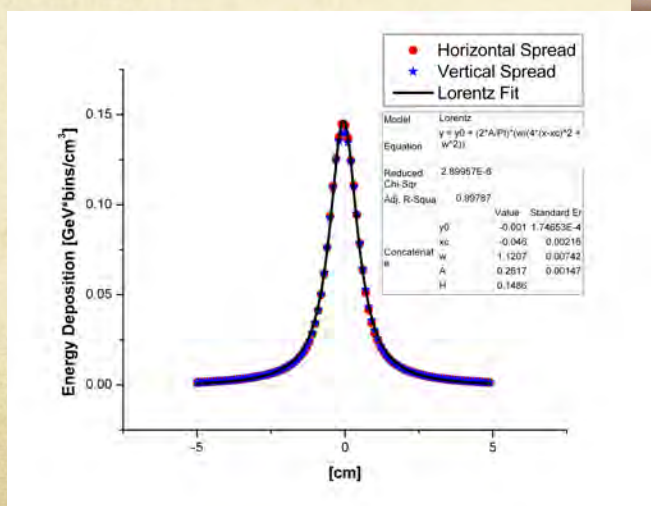
SPS Test



- Johannes Stiller (undergraduate) had done extensive work on this
- Good agreement between data and simulation
 - We understand how to use FLUKA
- Some small systematic errors not included
- Detector performs as expected

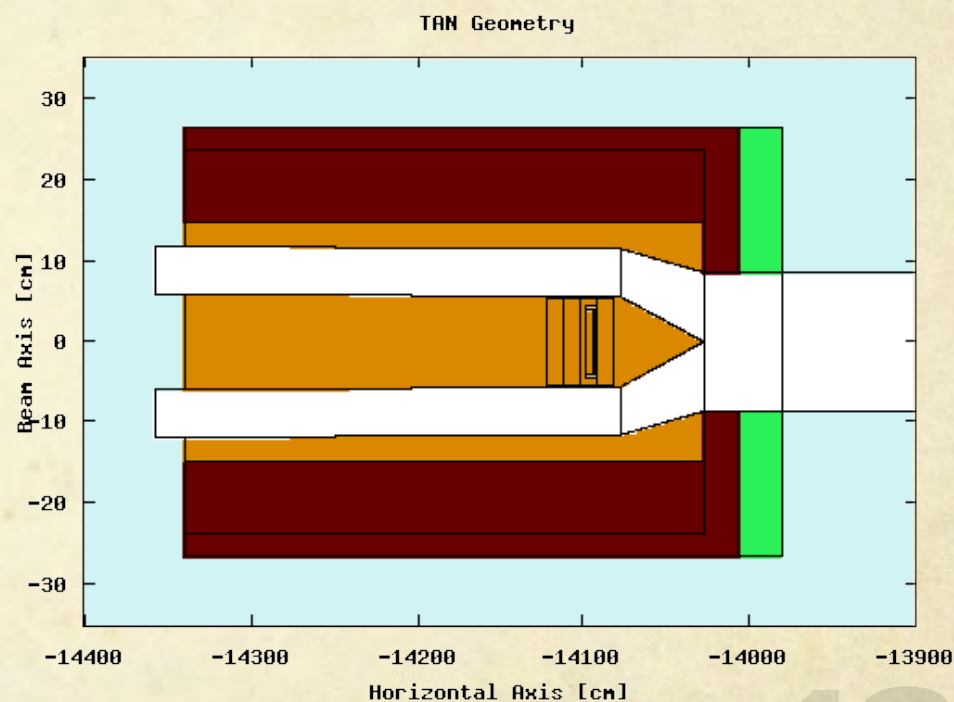
4 quadrants imply a gap

- Dead spot in chamber
- Tested with very narrow beam
- Gains of each channel were not normalized
- Insignificant for wide beams (> a few mm)



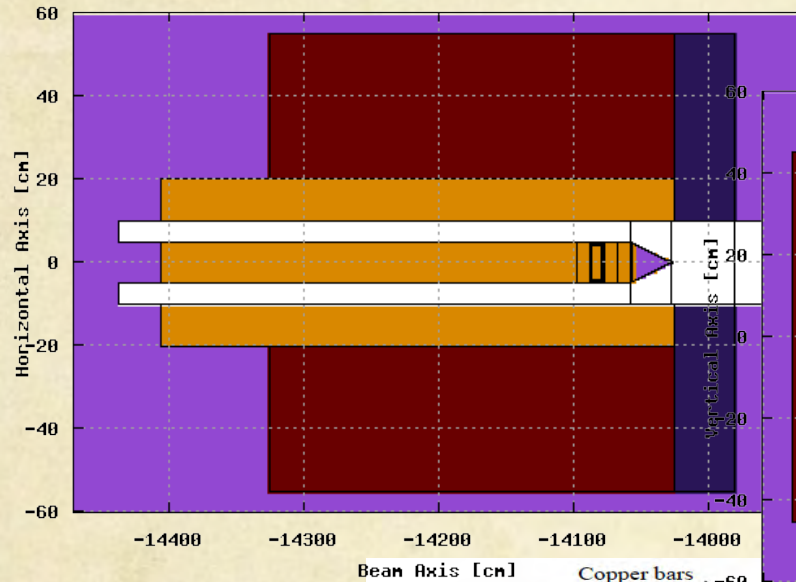
Fluka Study of LUMI

- Use Fluka to model LUMI in TAN
- Data files provided by LHCf at three LHC energies
- Files generated by DPMJET modal and projected to the TAN using EPICS

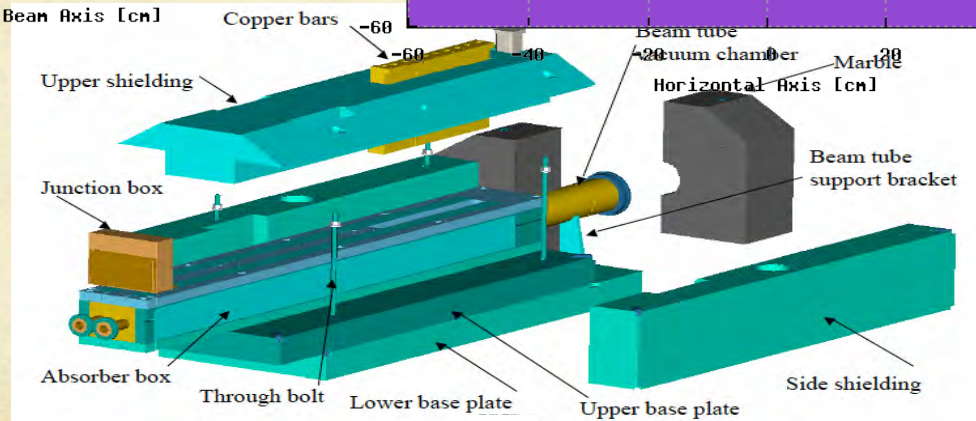
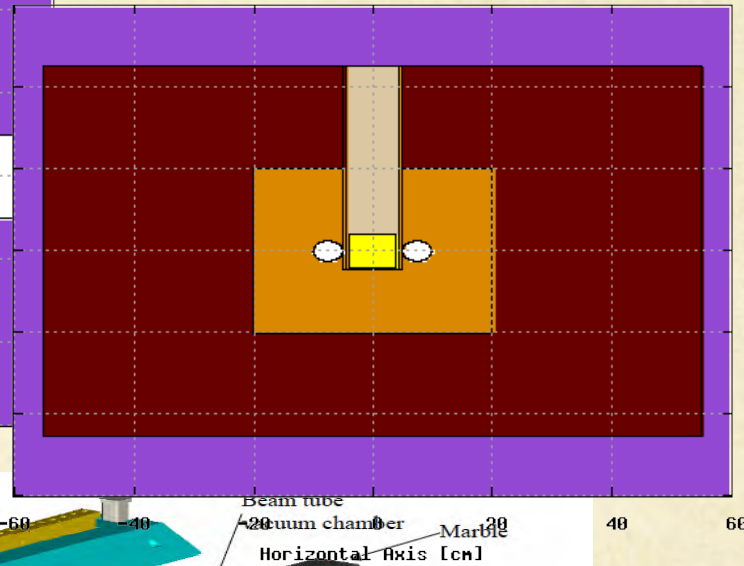


TAN Geometry in Fluka

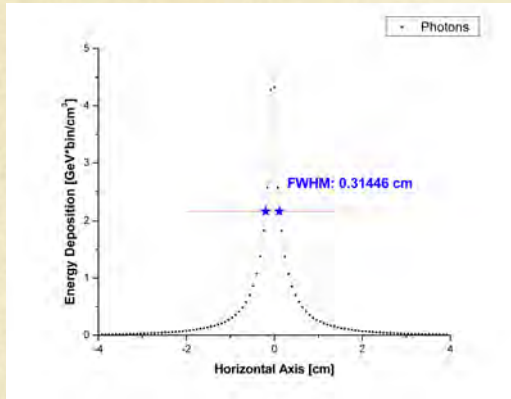
The BRAN inside the TAN



The BRAN inside the TAN



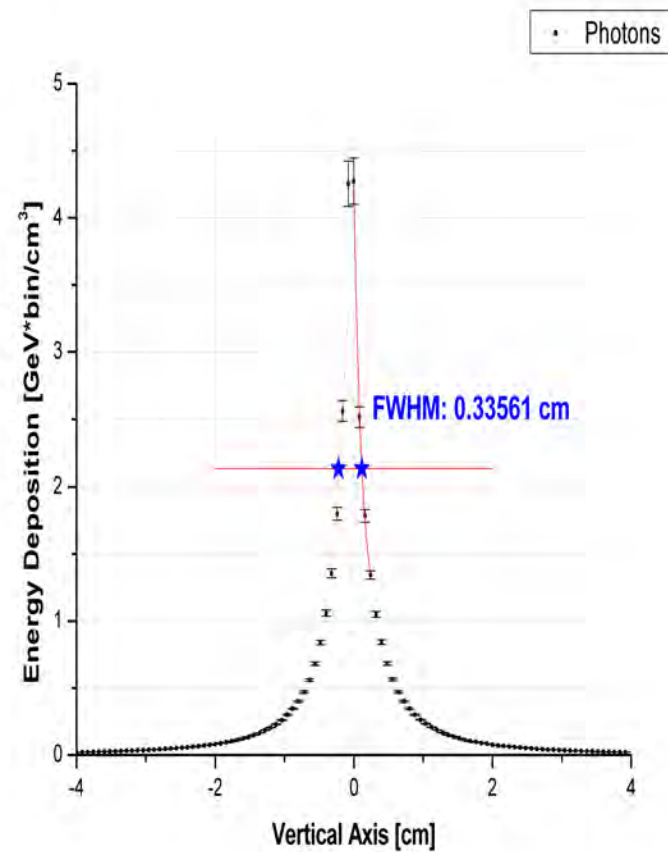
Simulated Pencil Beam - Photo



Beam Size $|x,y| < 0.01$ cm

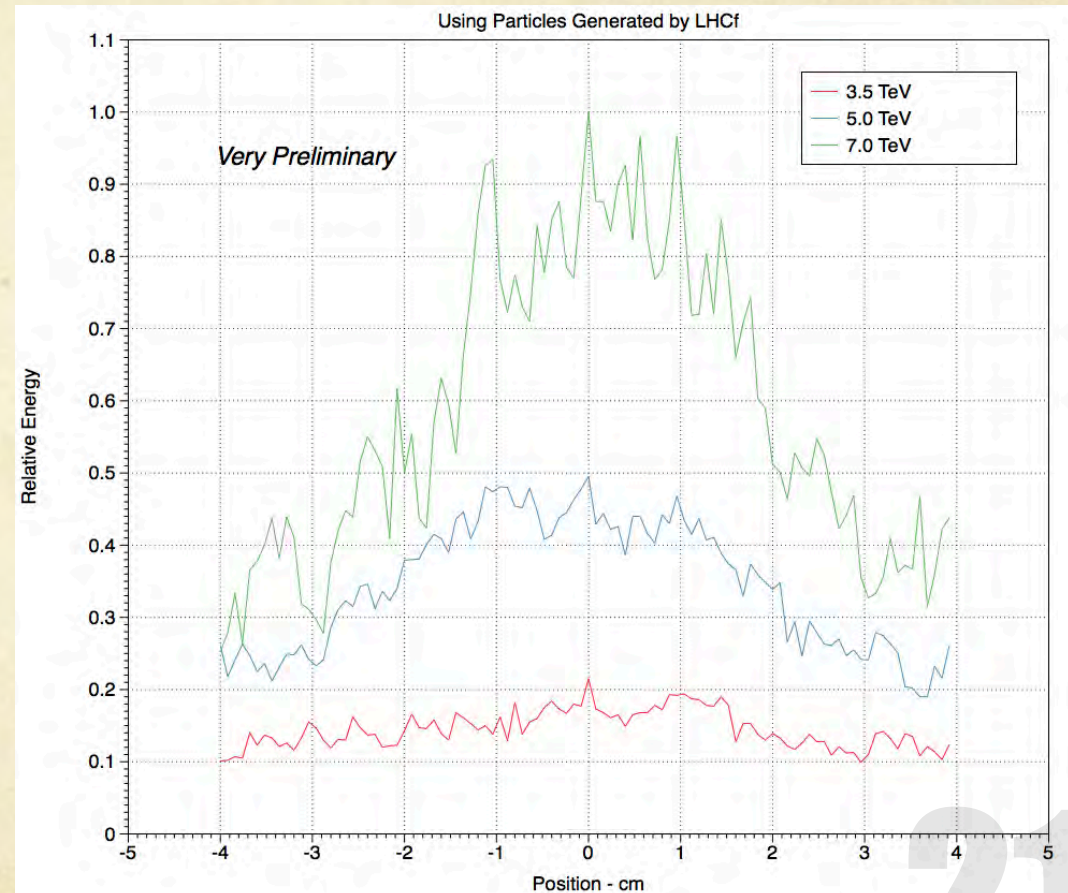
$[x,y,z] = [0,0,-13980]$

Energy: 456.77 GeV



Study Response of Detector vs. Position

- Use three energies
- LUMI segmented into four 4 cm detectors
- Will measure integral of this distribution
- Crossing angle looks good at 7 TeV



<

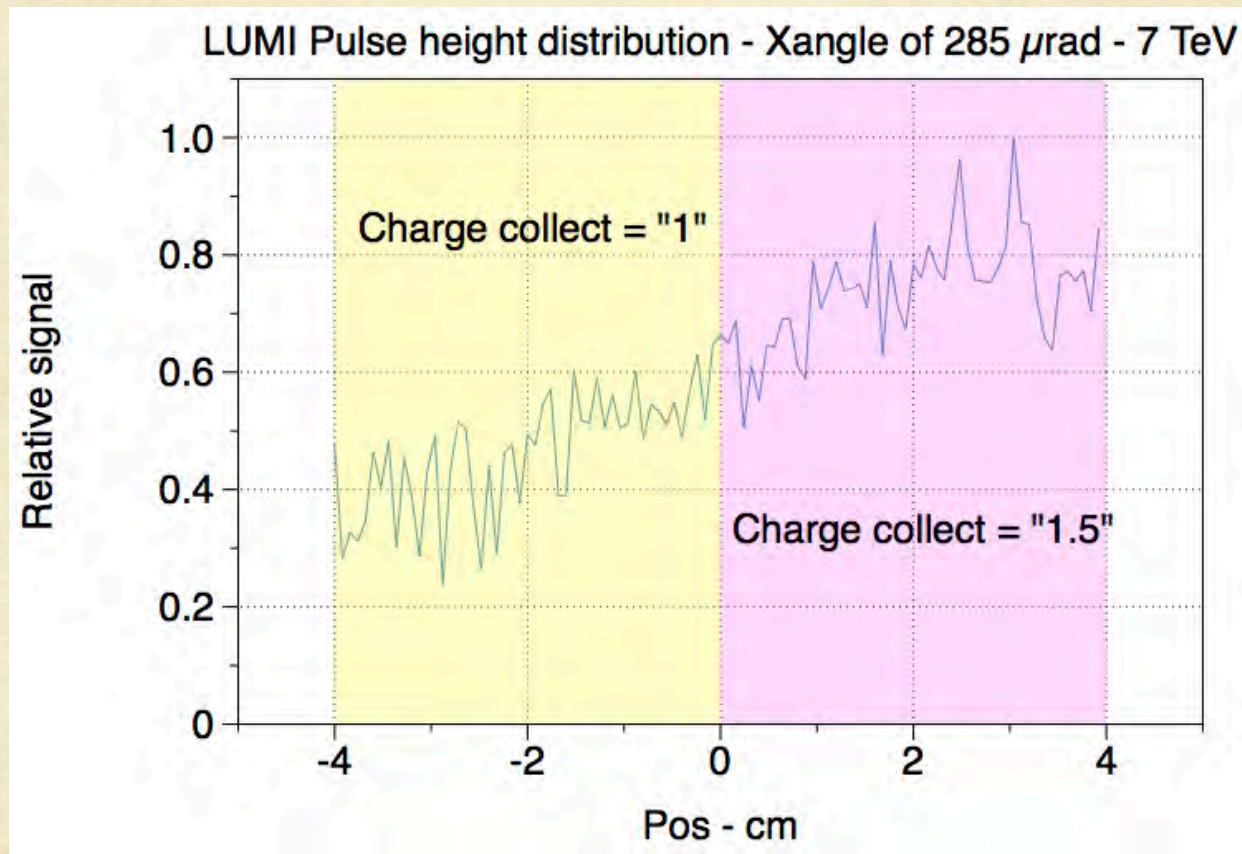
Sum of left

> <

Sum of right

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IP5 @ 7 TeV

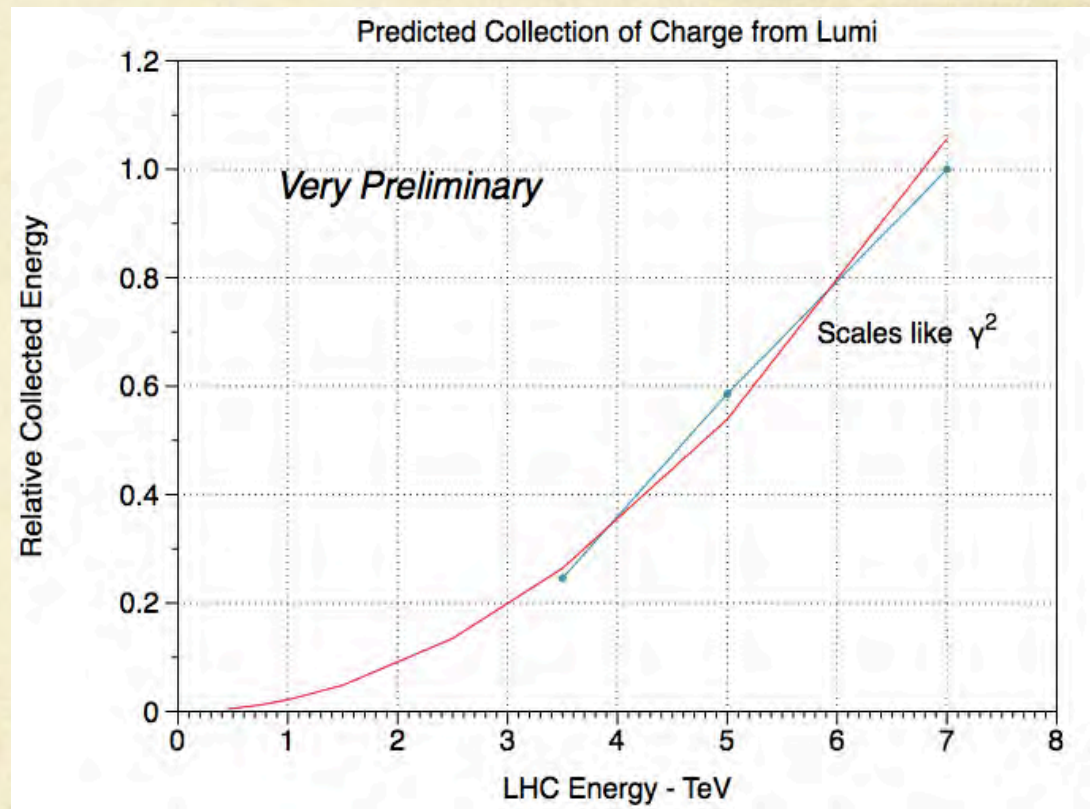


Simulated Data from Vadim Talanov

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Energy Scaling of LUMI

- Very preliminary
- Plotting average pulse height
- Sum of all quadrants
- Need to check scaling of data
- Big difference from 7 TeV to 3.5 TeV



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Commissioning Plans - Outlook

- Ryoichi Miyamoto (Toohig fellow) actively involved and now at CERN as LTV
 - LARP resident point of contact @CERN for Lumi monitors
- First task understand noise levels of system
- Strong dependence on LHC operating energy
 - Preparing Fluka models to simulate various scenarios
 - Good collaboration with other groups
 - LHCf and V. Tanalov providing valuable input
- Commission first at IP5
 - LHCF will not be in TAN for initial tuning @ Pt 1
 - Need absorber to produce showers

Commissioning Plans

without beam

- Test with detector under pressure + bias
- Background noise measurements with energized equipment
 - Repeat summer measurements with experiments running
- Pulse height noise spectrum

Commissioning Plans

with beam, no collisions

- Background studies with single circulating beam
 - Beam-gas effects
 - Scraping and collimation effects
 - Other localized noise sources
 - Data from different IP optics configurations
- Integration with LHC timing system and firmware commissioning with beam
- Test coincidence with PMT

Commissioning Plans

with beams in collision

- Threshold studies
- Correlation with PMT
- Pulse height spectrum analysis
 - Comparison with simulations
- Energy dependent studies
 - When LHC operates at different energies

Summary

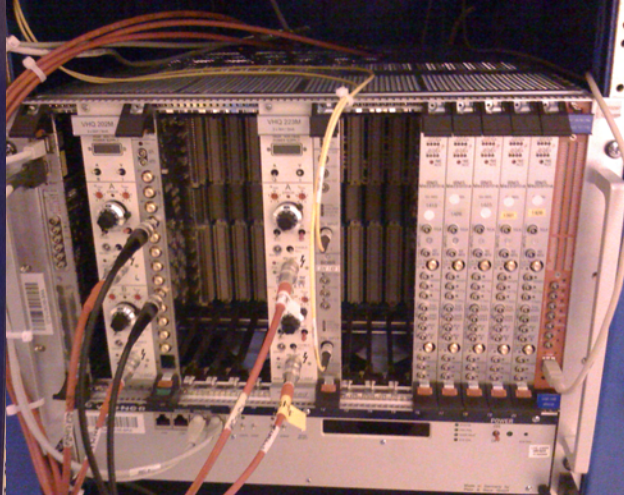
- LUMI (BRAN) ready for LHC commissioning
- Have tested and studied LUMI prototype
 - Tests agree absolutely with Monte Carlo Simulations
- LUMI designed for 7 TeV operations
 - Detailed simulations for response at lower LHC operations in progress
- We have an enthusiastic LARP crew plus our CERN hosts to commission detectors

Backup

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CMS Rack



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BRAN@ 5L (CMS)



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